

# InterAct

**Performing Well Integrity  
Reviews for Injection and  
Hydraulic Fracturing  
Permit Approval**

**Uliana Micovic**  
October 8, 2014

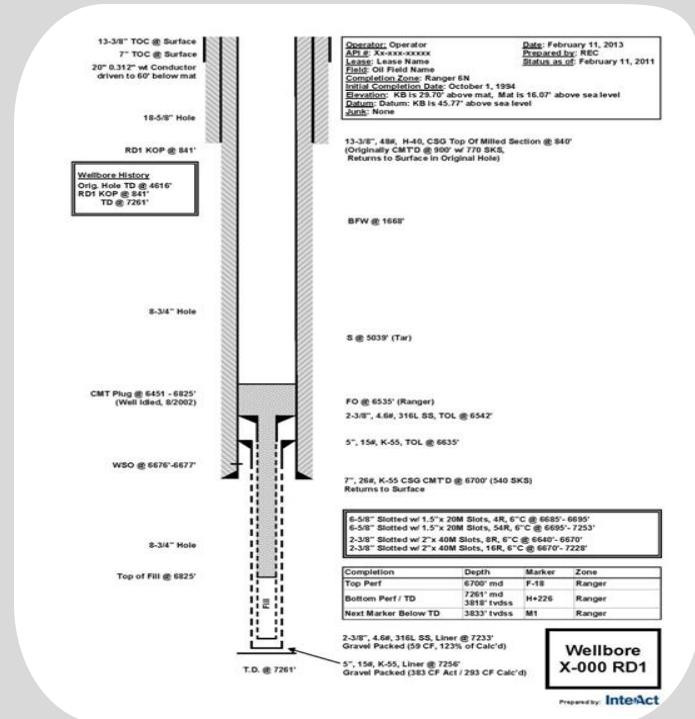
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# Prevention of Water Contamination

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- The purpose of the UIC Program and SB4 Regulations is PREVENTION of useable water contamination (protected, drinking, fresh water)
- Ensure that injected fluids (liquids disposal or hydraulic fracturing) do not have a path to Protected Water and would remain confined to the designated injection zone(s)
- Well Diagrams are an important tool in determining if Protected Water is protected



**UIC** = Underground Injection Control = Class II Injection wells

**SB4** = Senate Bill 4 = Law that requires regulation of Well Stimulation Treatment activities such as hydraulic fracturing and acid treatments

**TDS** = Total Dissolved Solids

**ppm** = parts per million = mg/L

**BFW** = Base of Fresh Water

**Fresh Water (DOGGR)  $\leq 3,000$  ppm TDS**

**Protected Water (SB4)  $\leq 10,000$  ppm TDS**

**USDW = Underground Source of Drinking Water (EPA)** – “An aquifer [...] that supplies a public water system or has a sufficient quantity of groundwater to supply a public water system [...] or **that contains  $\leq 10,000$  mg/L TDS**

and

is not an exempted aquifer.”

# What is being protected?

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## Common Definitions -- Water Quality in terms of TDS:

Distilled: 0.5 – 1.5 ppm

Lakes: 50 – 250 ppm

Drinkable: <1,000 ppm

Brackish: 1,000 – 5,000 ppm

Highly Brackish: 5,000 – 15,000 ppm

Saline: 15,000 – 30,000 ppm

Sea Water: 30,000 – 40,000 ppm

Brine: 40,000 – 300,000+ ppm

### TDS constituents:

$\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  
 $\text{Cl}^{-}$ ,  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^{-}$ ,  $\text{NO}_3^{-}$ ,  $\text{SO}_4^{2-}$ ,  
Boron, Bromide, Iron,  
soluble organic matter



### Definition of “Protected Water”

in California has changed from 3,000 ppm TDS to 10,000 ppm TDS (EPA letter to DOGGR regarding Class II wells)

How does Protected Water (10,000 ppm TDS) taste?  
“Tastes like canned soup”



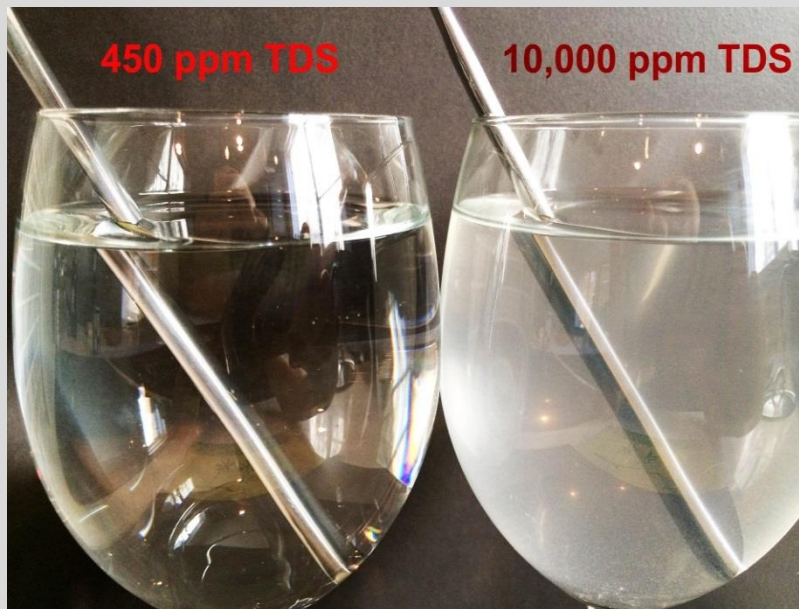
# H<sub>2</sub>O Potable vs. Protected

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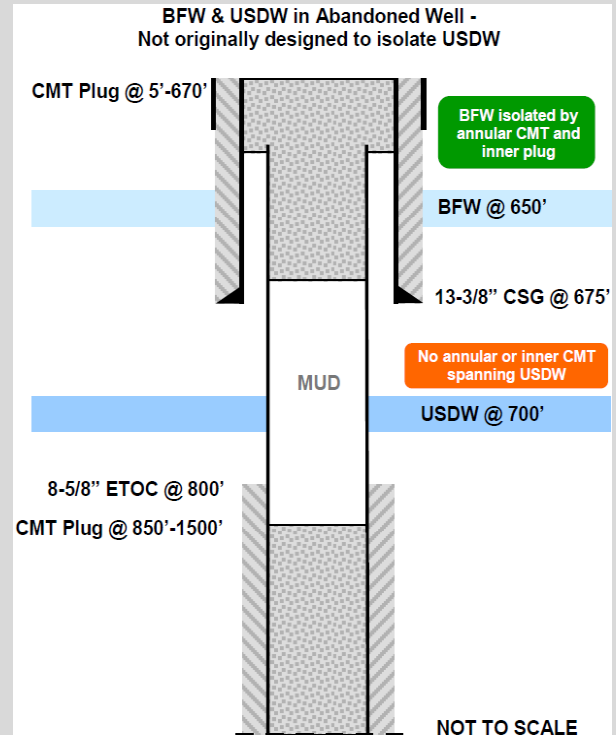
**Canned Chicken Noodle soup = 11,200 ppm Dissolved Solids as NaCl (per the data on the can)**

**Fresh water vs. water with 10,000 ppm TDS:**

- could be cloudy
- slightly higher Refractive Index
- slightly higher density



- **BFW vs. USDW**
- **EPA and DOGGR definitions**
- **Prevention of contamination of USDW**
- **Zonal Isolation for USDW**
- **USDW is typically located deeper than BFW**

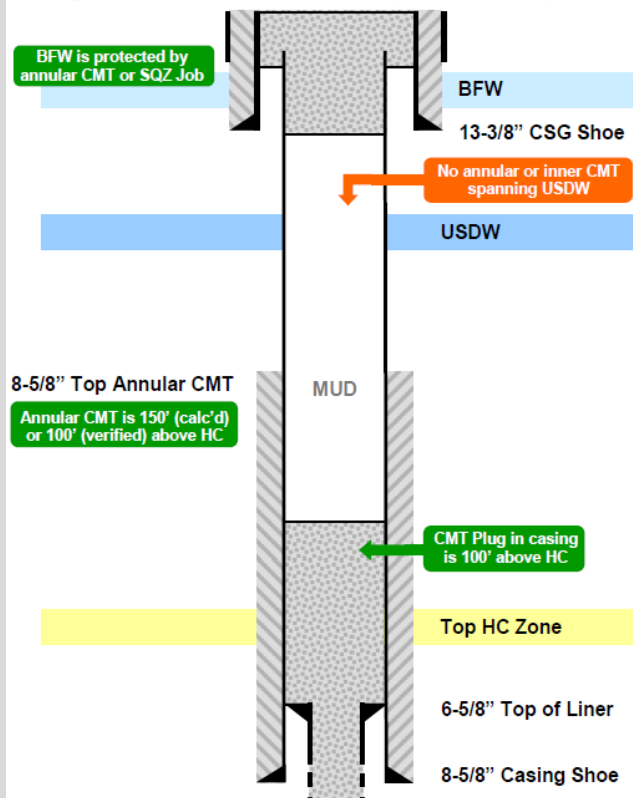




# UIC Requirements

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Original Abandonment for BFW and Hydrocarbon (HC) isolation



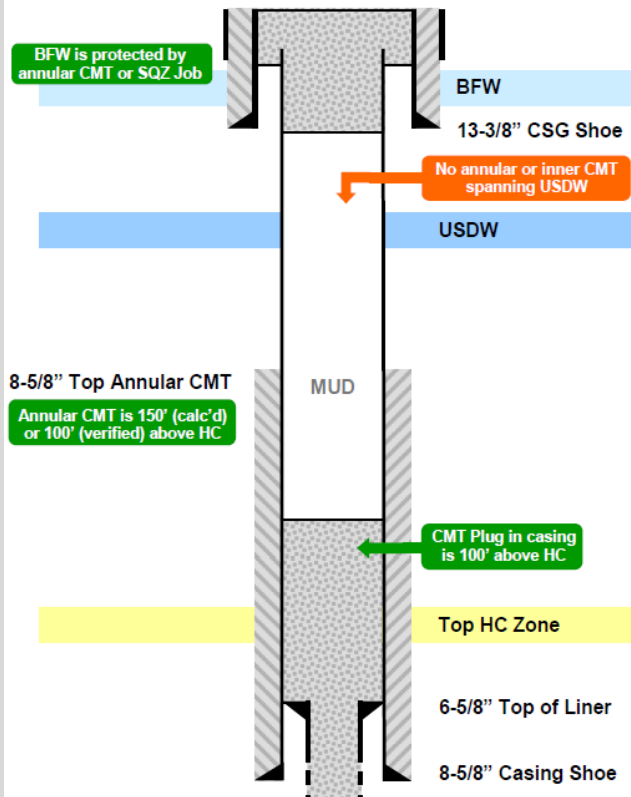
- Protected Water may not be cemented properly in older wells because its definition has changed
- Implications for operators
- Do some existing wells near the active injectors need to be re-abandoned?
- Planning for injection wells location may have additional challenges



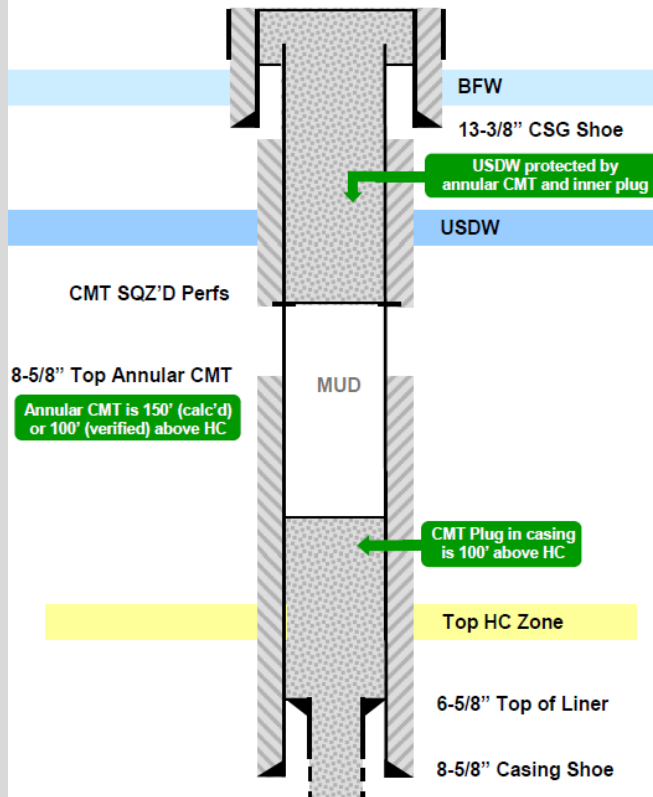
# UIC Requirements

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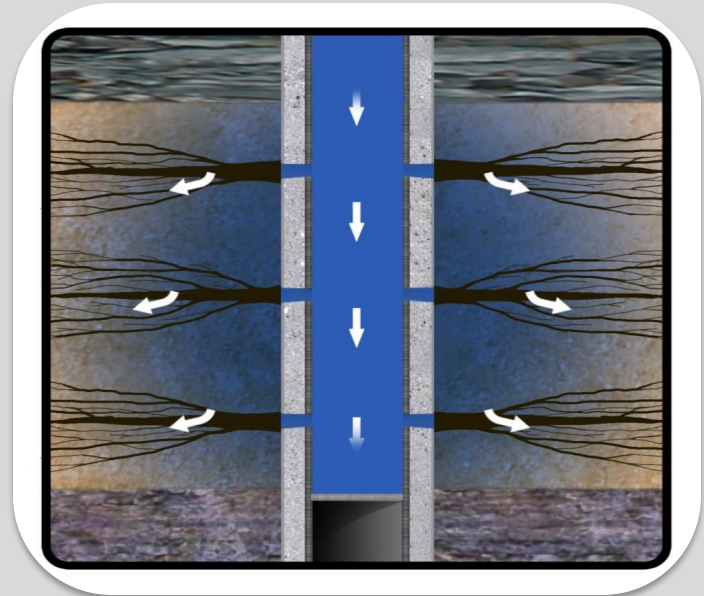
Re-Abandonment for USDW and Hydrocarbon (HC) isolation



## For a Hydraulic Fracturing or Acid Stimulations:

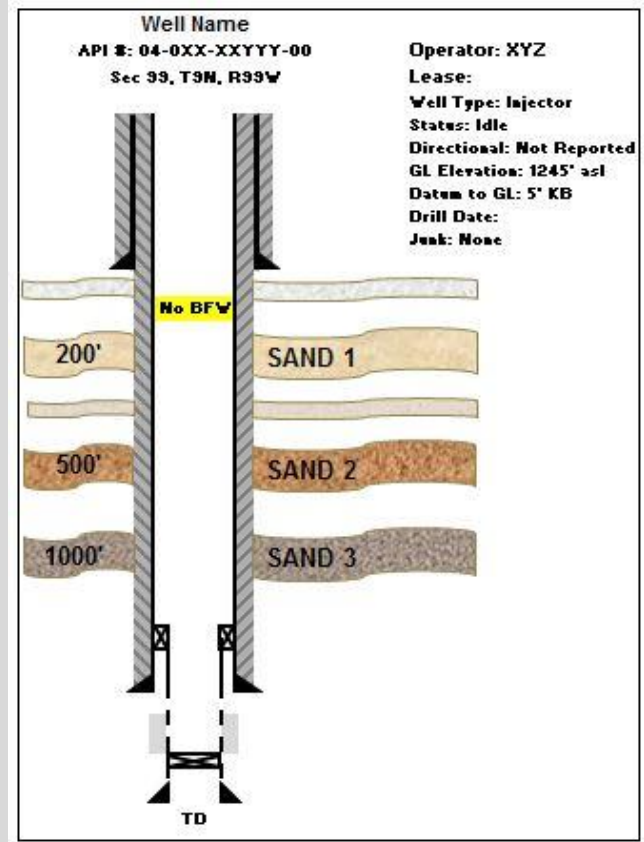
- Prepare and submit Well Stimulation Treatment (WST) Notice to DOGGR
- Detailed well data and proposed activities information
- Disclosure of injected chemicals
- List of neighboring wells
- Water Management Plan
- Neighbor notifications
- **Groundwater Monitoring Plans (GMP)**

The majority of difficulties in the approval of WST Notices is preparation and approval of GMPs



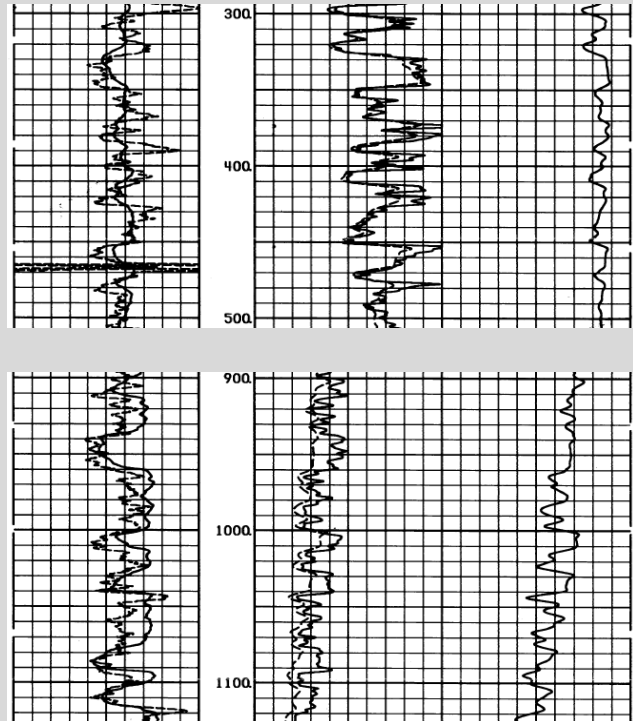
## Difficult Case for a Groundwater Monitoring Plan:

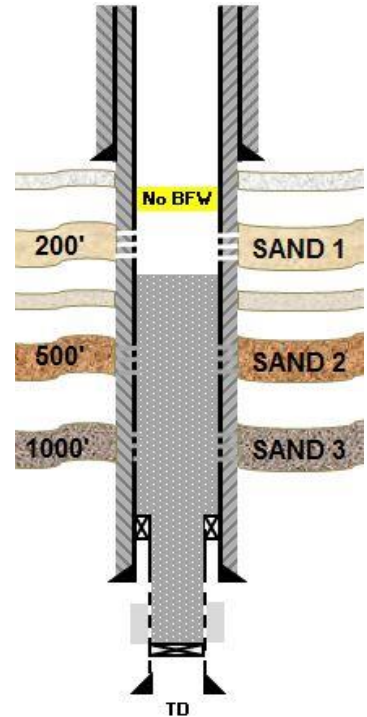
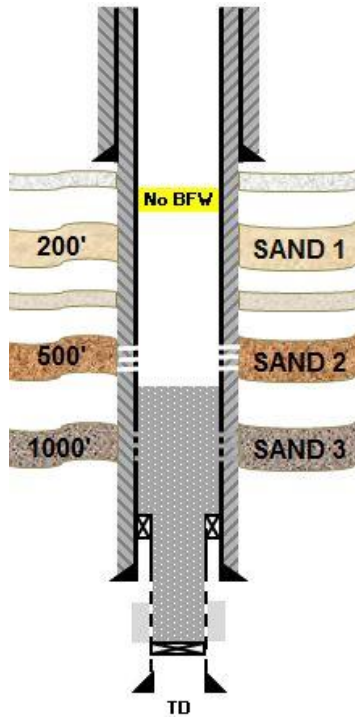
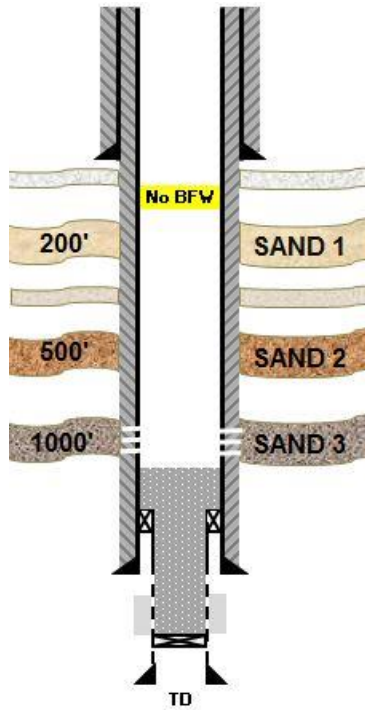
- There is no BFW per DOGGR
- No water wells in the area
- No water monitoring wells
- Most well logs start at >1,200'
- 1 Well log shows potential water in sands above HC zone
- Where is Protected Water?
- SB4 still requires groundwater monitoring



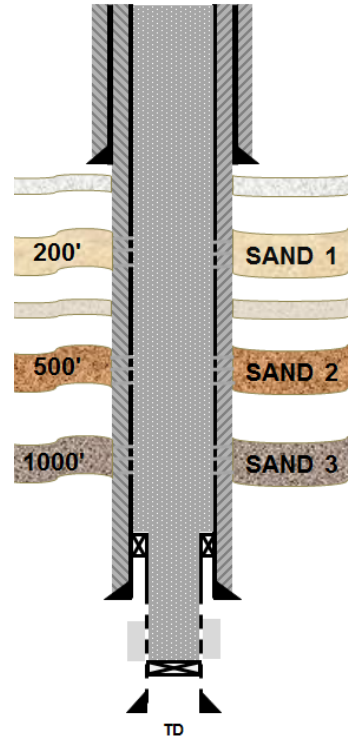
## Difficult Case for a Groundwater Monitoring Plan:

- Conventional method of estimating salinity/TDS is analysis of electrical well logs
- Only 1 available well log had the shallower horizons (other wells within a mile from the WST wells were cased through 1,200')
- DOGGR and Water Board require a water sample to prove TDS (calculations would not be accepted)
- SB4 Regs require groundwater monitoring at the base of Protected Water

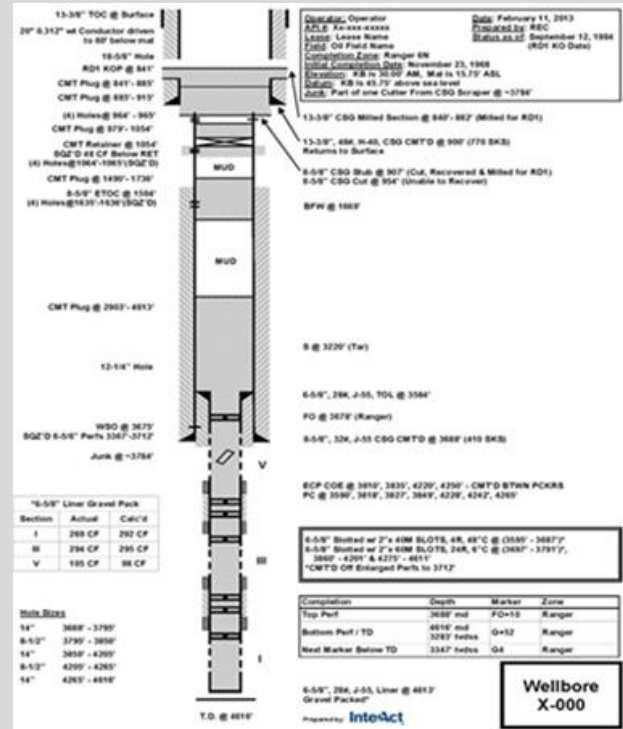




**State Water Board may  
issue a Written  
Concurrence if a study is  
presented to demonstrate  
there is no Protected Water**



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*We plan. We engineer. We deliver. **You succeed.***